Visualizing the knowledge of Voluntary and Nonprofit Sector Research: Panorama and Foundation

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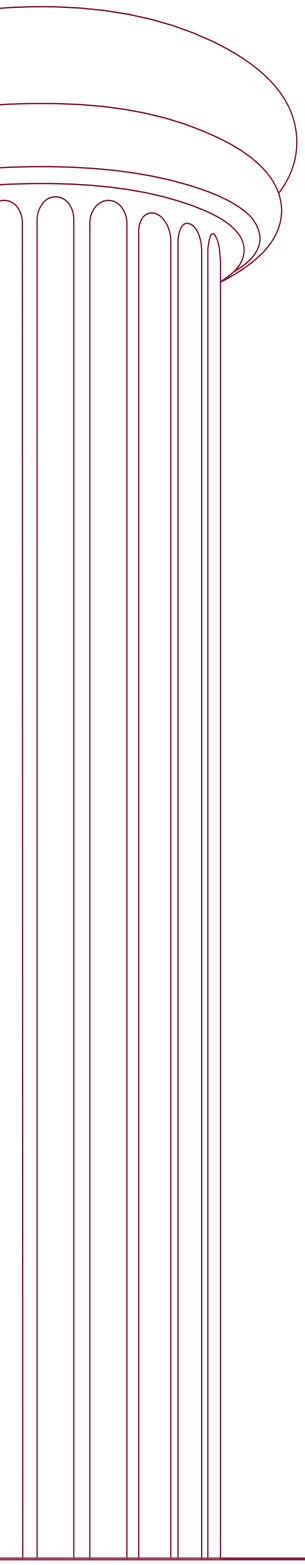

Min Chen and Chao Min

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1. Introduction

The blooming of the voluntary nonprofit sector (VNPS) after the 1970sled to increased academic interest in VNPS research. Contributions to this field stem from very different disciplines, such as political science, economics, sociology, anthropology, psychology, and marketing. Almost 40 years ago, Smith (1975) designated that “scholars concerned about voluntary action research should consciously seek out cross-disciplinary inputs (p.248)”. Later, Katz (1999) indicated that there is a strong tendency toward a new and multidisciplinary field in social sciences after the 1970s. Nonetheless, uncovering the interdisciplinary nature of VNPS research is rather difficult. Moreover, it is harder to understand how this new field reconstitutes this knowledge and establishes new areas of research.

In the past 40 years, some academic studies have reviewed VNPS knowledge through the use of literature reviews. For instance, Tomeh, (1973) and Smith (1975) conducted literature reviews on voluntary organizations and voluntary action. Pugliese (1986) and Layton (1987) wrote an annotated bibliography of philanthropy and volunteerism. Likewise, Smith (1994) developed a comprehensive account of American social science literature on participation and volunteering in voluntary associations between 1975 and 1992. Lately, some literature reviews have attempted to concentrate on a few major issues in this emergent sector, most notably Mercer's (2002) account of the role of NGOs in the politics of development and Bekkers and Wiepking's (2011) overview of empirical studies in the charitable giving literature.

Shier and Handy (2014) have investigated the trends of VNPS dissertations and theses between 1986 to 2010, and their findings contain statistical descriptions of the historical developments, main themes, and research topics present in these publications. The result is a visualization of the interdisciplinary linkages in this field of research. However, the study employed a manual labelling method to the abstract only; therefore, only primary thematic analysis can see from the main findings. Although this research demonstrates a clear trend in dissertation theme, there is a lack of comprehensive and in-depth interpretation of the academic context on a greater basis.

Consequently, this paper attempts to fill the research gap by applying Scientometrics to VNPS research. Scientometrics was first introduced by Nalimov and Mulchenko (1969) to describe the study of all aspects of the literature of science and technology

such as growth, structure, interrelationships and productivity. According to Hood and Wilson (2001), this method can be applied to analyze the practices of researchers, the organizational structures, research and development management, and the role of science and technology policies. Scientometrics is a useful method for describing, visualizing and understanding the knowledge network of a research field. However, there have been few studies using this method in social science (For example Katz, 1999, and M. Chen & Liu, 2015).

The foremost purpose of this study is to describe and analyze the knowledge network and flows in VNPS research quantitatively. 5,107 articles and 203,541 references are sampled from Web of Science's (WoS) Social Sciences Citation Index (SSCI) database in this study. Hence, this enormous citation data will analyze by utilizing different algorithms, and the results will be visualized via different citation network diagrams, a novel approach in this area. The paper is structured as follows. First, a detailed exposition of the data and methods underpinning this study is provided, followed by presentation of the empirical results which are grouped into four categories: trends of knowledge construction in the field of VNPS in social science;

1. knowledge building at the institution, county and individual levels;
2. the change and continuity of research foci; and
3. collaboration network analysis.

The paper concludes with a reflection on the implications of the study with respect to VNSP research and other social science fields, as well as suggestions for future studies.

2. Methodology and Data

2.1. Methodology

As mentioned briefly in the introduction, Scientometrics was applied to describe the study of all aspects of the literature of science and technology to draw the growth, structure, interrelationships and productivity of one research field. Since then, there has been explosive growth Scientometrics research. In 1978, Tibor Braun founded the Journal of Scientometrics and further extended its recognition (Hood & Wilson, 2001). The subtitle of the journal suggested that Scientometrics includes all quantitative aspects of the science of science, communication in science, and science policy (*ibid*). Leveraging their role in the founding of this, Nalimov and Mulchenko (1969, 1971) made critical contributions to the nascent topic of Scientometrics.

Certain regularities, distributions or laws fundamentally essential to the development of Scientometrics were established in the early stages of the academic development literature. For example, Lotka's law defines the relationship between authors and papers (Lotka, 1926). Bradford's law dealt with the problem of the scatter of papers on a subject through the scientific journals (Bradford, 1934) and Zipf's law related with word frequency or occurrences (Zipf, 1949). Additionally, Campbell (1896) used statistical methods for studying subject scattering in publications and Cole and Eales (1917) studied the growth of the comparative anatomy literature for the period 1550-1860. Hulme's (1923) work is another early study, using document counts to provide insight into the history of science and technology. Therefore, Scientometrics has a well-recognized foundation.

According to Wilson (2001), Scientometrics can apply to the practices of researchers, the socio-organizational structures, research and development management, the role of science and technology in the national economy, governmental policies towards science and technology, etc. For example, Nagpaul, Garg, and Gupta (1999) published 13 papers on emerging trends in Scientometrics, categorized in three parts: Scientometrics and science and technology policy, including an introduction to the subject of, scope of and methodology used in Scientometrics; the structure and dynamics of science, including individual level up to international level of collaboration among scientists; and regional aspects of science in India. In essence, Scientometrics quantitatively analyzes the patterns hidden in scientific literatures in order to better understand the trends and topological structure in a research field.

A computer software program named Citespace, common to Scientometric studies, is utilized in this study and works as follows: it usually takes scientific literature as input, and generates visualizations of the complex topological structure of knowledge, and then enables statistical analysis and interactive data exploration. CiteSpace was designed and widely used to detect "popular fields", trends and networks in literature. This research applied CiteSpace to generate the co-citation network based on the papers acquired from Web of Science. With CiteSpace's co-citation analysis and co-occurrence analysis, it dissects knowledge by cited reference, co-word, cited author, cited journal, institution or country, etc.

Scientometrics entails the usage of a particular nomenclature and it is necessary to define a few key terms utilized in this paper. A node represents an actor in a network analysis. In this study, a node could be an institution, author, publication or any actor that has relations (ties) with others in a network. Centrality refers to the importance of a node in the network. To put it simply, the higher the centrality, the bigger the node will appear in the network graph, and the more important this node is in the network. Moreover, Burst measures the emergence of a topic (or literature, authors, journals) in the network. For instance, if one article has suddenly been cited much more than the previous year then it counts as a burst in that particular year. The greater the node emergence, the larger value of burst shown in the network graph, and thus the darker in color the circle of that node will get. TF-IDF, LLR, and MI are three methods for labelling the clustering results. Due to the limitation of this paper, these methods will not extend.

2.2. Data Collection Strategy

This paper draws on one database for its sample of articles and citations: SSCI from the WoS database published by Thomson Router, operated by Thomson Scientific, Philadelphia, PA, USA. The data collection strategy is composed of the following four steps.

2.2.1 Database Selection

As a strictly selected database, WoS, SSCI has long been recognized as the most authoritative scientific and technical literature indexing tool, providing data on important areas of science and technology research, especially in the social sciences. It indexes many of the best-regarded journals related to politics, public policy and other major subject areas associated with VNPS research.

2.2.2 Keyword Selection

We adopt the research key terms Shier and Handy (2014) applied to the ProQuest database. The key terms are ("volunt*") or ("nonprofit") or ("non-profit") or ("civil society") or ("third sector") or ("NGO") or ("nongovernmental") or ("NPO"). It is important to note that Tsinghua University only purchases the full dataset of WoS going back to 1998; therefore, there is considerable missing data for articles and references published prior to that year. As a result, only articles published since 1998 are includ in this study.

2.2.3 Exclude irrelevant matter

To narrow down the findings and only focus on academic research, we excluded editorial material, notes, letters, book reviews, and news items. These exclusion criteria are commonly used in other Scientometrics studies (Falagas, Karavasiou, & Bliziotis, 2006; Soteriades & Falagas, 2006). Consequently, this paper only focuses on journal articles and conference proceedings papers which have been peer-reviewed that make an original contribution to knowledge.

2.2.4 Refine the Subject Category

We then refine the sample with respect to subject category to ensure that papers are related to VNPS research. The data collection strategy produced many papers that are not directly related to VNPS research. For example, Psychology and Medical Research articles used the word “volunteer” to describe participants of scientific experiments generally. In the end we manually excluded subject areas which had less than 100 papers, followed by a manual assessment of each of the remaining categories to see whether the article refers to VNSP research. In the end, 5,107 papers are from following categories: Social Issues, Political Science, Public Administration, Anthropology, Economics, Communication, Ethnic Studies, Sociology, Management, Urban Studies, Area Studies, Environmental Sciences, Planning Development, Environmental Studies, Business, International Relations, Social Work, Social Sciences Interdisciplinary, Law, Education Educational Research, Business Finance, and Ethics.

3. Findings

To address the above issues, the finding begins with laying out and visualize the citation and journals analysis to see whether VNSP research became more important in the social science field. It then focusses on institution, country and author analysis to find out who is doing what in the past 17 years. The third part of the finding will uncover the keyword, high centrality articles analysis and will visualize the course of evolution of the core articles over the years. The final part of finding will be trying to visualize an existing collaboration network by adding all the results above.

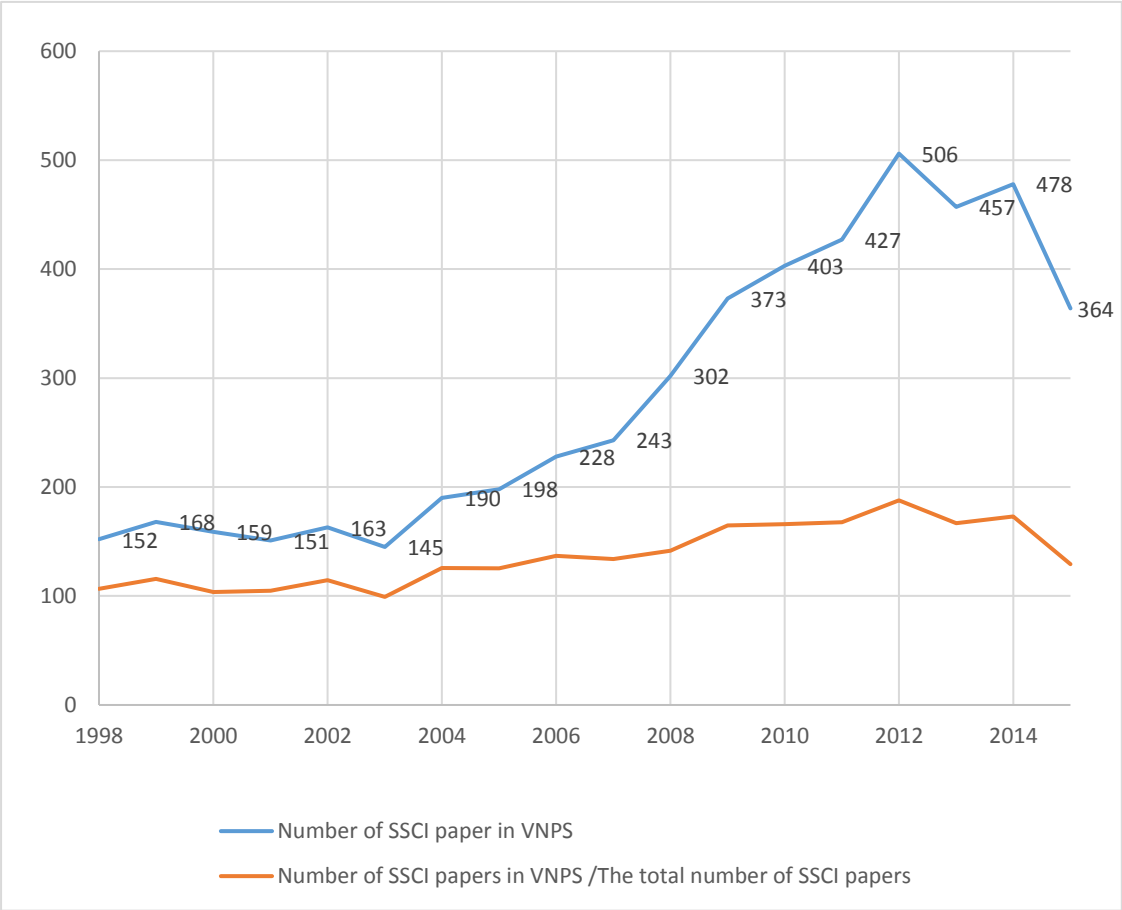
3.1.: Trends of knowledge construction in the field of VNPS in social science

3.1.1 Publication trends

The number of SSCI papers on VNPS is quite stable each year until a rapid increase after 2003 as shown in Graph 1 (blue line). However, only showing the numbers of SSCI papers on VNPS does not indicate growing importance for this research area. Therefore, we use all SSCI papers in WoS as a base to divide the SSCI papers in VNPS, to see if there is an increase in density of VNPS papers in the social science literature. To compare those values, we multiply the percentage by 100,000 and unite two lines together into Graph-1. The blue line measures the growth in VNPS papers over time, and it is clear that the number of papers increased in 2003 and continued to do so until 2012. The number of papers in 2012 is almost three times more than in 1998. From this perspective, VNPS research experienced a relatively significant increase in the total number of papers published in the field.

Moreover, the orange line measures the growth in VNPS publications as a proportion of all SSCI papers on WoS. From this perspective, VNPS research has not increased substantially over the study period; this finding is inconsistent with Shier and Handy (2014)'s results which suggest the percentage of VNPS research increased dramatically over the last three decades. A possible explanation for the inconsistency is that growth of publications in the field of VNPS might be a result of the increase of SSCI publications in general. That is why the orange line is steady compared to the blue. Therefore, the seeming increase in interest in VNPS research is simply a function of the growth in papers overall (i.e. "inflation" rather than actual growth). Alternatively, the data suggests an encouraging increase in social science publications in the VNPS field. To conclude, VNPS research is a component of social science studies, but there is no sign of a sudden, expanding research interest in this field.

Graph **1. Publication trends of VNPS papers**



3.1.2 Journals Analysis

The field of VNPS has a number of specialized journals such as were Nonprofit and Voluntary Sector Quarterly, VOLUNTAS and Nonprofit Management & Leadership. But our 5,107 articles are from more than 1,000 academic journals. We examined the highest citation journals and found 90 journals cited the majority of VNPS publications (see Table-1 for the top 18). Besides the journals specializing in VNPS, other journals are mainly from the fields of sociology, management science and economics. The results of citation frequency show that there is a high concentration of citations in these top journals, where approximately one-third of the articles appear in the most productive journals. This finding is in keeping with Bradford's law and is consistent with empirical results in other fields (Wang & Wang, 1998).

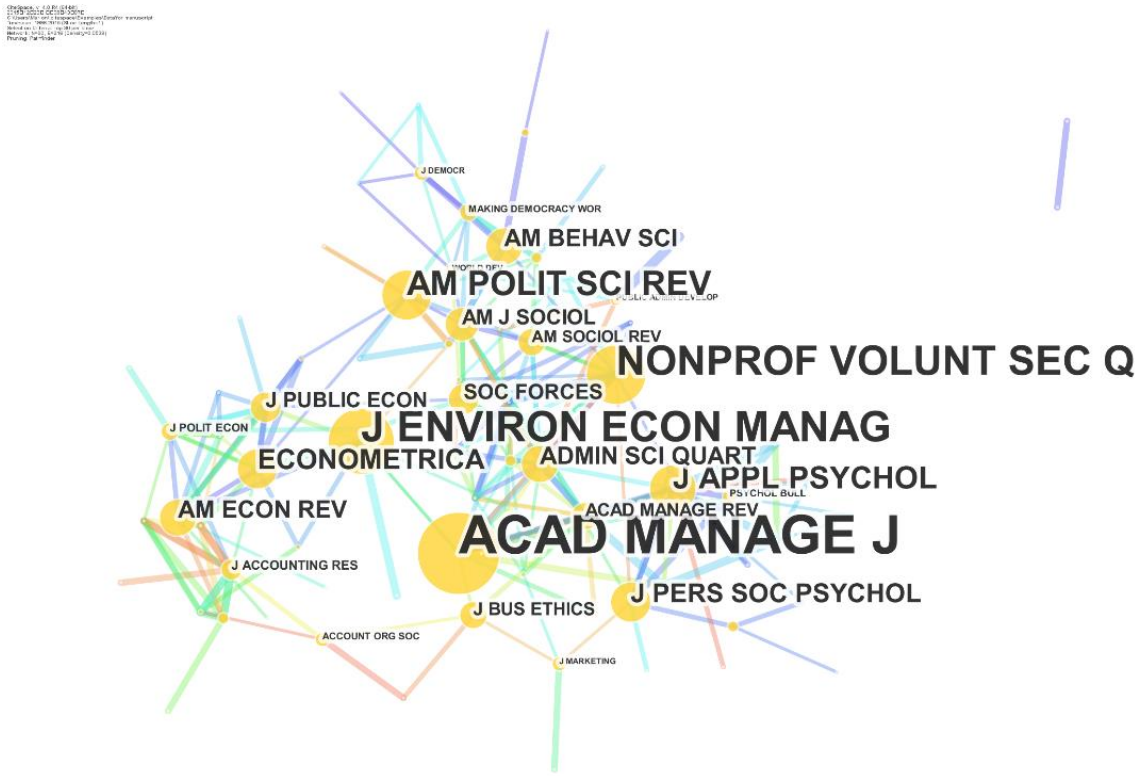
Table 1**. Top 20 Most influential WoS Journals On VNPS**

Journal	**Citation Frequency**	**Centrality**
Nonprofit And Voluntary Sector Quarterly	988	0.25
American Sociology Review	687	0.11
Voluntas	577	0.02
Nonprofit Management Leadership	552	0.01
American Journal of Sociology	530	0.13
Academy of Management Review	521	0.11
Academy of Management Journal	496	0.34
American Economic Review	475	0.15
Annual Review of Sociology	458	0.03
Public Administration Review	405	0.05
Administrative Science Quarterly	397	0.15
Journal of Public Economics	384	0.13
Journal of Personality And Social Psychology	344	0.16
American Political Science Review	335	0.21
Quarterly Journal of Economics	329	0.01
Journal of Political Economy	326	0.07
World Development	311	0.05
Social Forces	297	0.13

Besides, it is interesting to put these journals into one network to explore their connections and importance inside the network. We employ a novel method for achieving this, using software to measure the importance of a journal according to its “betweeness” centrality in the research network. As described in the method, high

centrality suggests a journal is essential and has better recognition in a network. In Graph-2, we see that the biggest node and biggest letters are journals mainly specializing in political science, economics and social science. In particular, we notice that high centrality journals are from the field of management science such as Academy of Management Journal and American Economic Review. Only one journal from the field of VNSP, Nonprofit and Voluntary Sector Quarterly, is prominent in the network. Figure 2 also displays the connections between journals. Within this network, Journal of Environment Economic Management has both high centrality and acts as a critical node connecting different topics. The articles in these journals are the most multidisciplinary as they link management, economics and political science publications together.

Graph-2. **Visualization of journal citation frequency, centrality and collaboration network**



* Graph-2 visualizes a citation network, where one node represents one journal, and bigger nodes suggest higher centrality.

Looking specifically at the NVPS specialized journals we see that three of the four have the high citation frequency but low centrality. The results above may suggest that publications in this research area do not reflect academic trends and popular

research topics in other disciplines and fields. Theories generated from VNPS studies may borrow heavily from wider social science research or are not applicable to other fields. In conclusion, the low centrality of prominent VNPS journals in the citation network further suggests that researchers in this sector should pay more attention to theory building.

3.2.: Knowledge Building at The Institution, County and Individual Levels

Scientometrics is a method by which the state of science and technology can be observed through the overall production of scientific literature at a given level of specialization. This tool provides an approach for situating a country within the world, an institution with another and individual scientists with their peers. The first part of this section will explore institutions' productivity, centrality and collaboration network. This is follow by country analysis and finally author analysis.

3.2.1 Institution Analysis

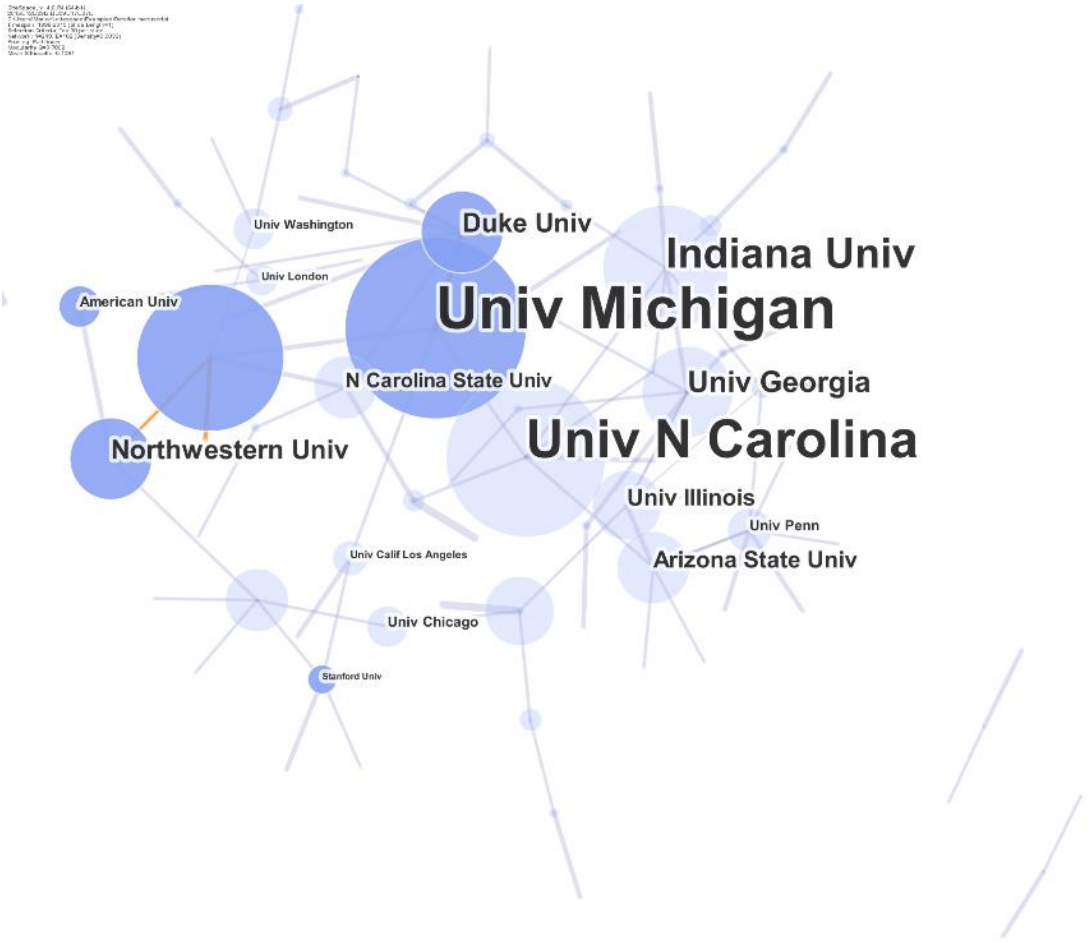
Table-2 presents the top 22 most influential institutions by publication frequency, centrality and PageRank value. Publication frequency shows an institution's productivity, while centrality suggests its influence in the co-authorship network. PageRank values evaluate an institution's general performance and importance in the network. The result shows that Indiana University has high productivity, centrality and PageRank, which suggests it has high influence, productivity and performance in VNPS research. The University of Michigan has the highest centrality, which suggests a core role in the collaboration network. Moreover, the University of Pennsylvania, University Of Georgia and Duke University have high frequency, centrality and PageRank too, but less than Indiana University. Moreover, George Washington University has remarkably high centrality and PageRank value, which suggest its powerful impact and good performance in VNPS research as a result of high-quality publications.

Table 2. **Top 20 most influential institutions**

Institution	*Publication*	*Centrality*	*PageRank*
Indiana University	50	0.05	2.62
University of Washington	44	0.02	1.32
University of North Carolina	43	0.07	1.86
University of Illinois	41	0.03	1.93
University of Pennsylvania	38	0.02	2.56
University of Michigan	38	0.08	1.92
Harvard University	37	0.03	2.11
University of Georgia	35	0.04	2.46
University of Wisconsin–Madison *	34	0	0.91
Duke University	33	0.04	2.84
London School of Economics and Political Science	32	0	0.58
Arizona State University	31	0.03	1.99
University of Southern California	30	0	0.49
University of Missouri	27	0	0.57
University of Minnesota Twin Cities *	27	0.01	1.32
University of Manchester	27	0	0.15
Stanford University	27	0.01	1.77
Georgia State University	27	0	1.46
University of London	26	0.01	1.5
The University of Maryland	25	0	1

We now visualize the collaboration between these organizations by drawing on the results from Table 2. In the interinstitutional collaboration network (Graph-3), bigger nodes mean higher centrality and more central positions in the network. The University of Michigan, University of North Carolina, Indiana University, University of Georgia, and Duke University, has the highest centrality. University of Michigan and University of North Carolina, in particular, have many external co-authoring collaborations. The contribution of these institutions to building this network are much higher than others.

Graph 3. **Visualization of Institution's Citation Frequency, Centrality and Collaboration Network**



3.2.2 Country Analysis

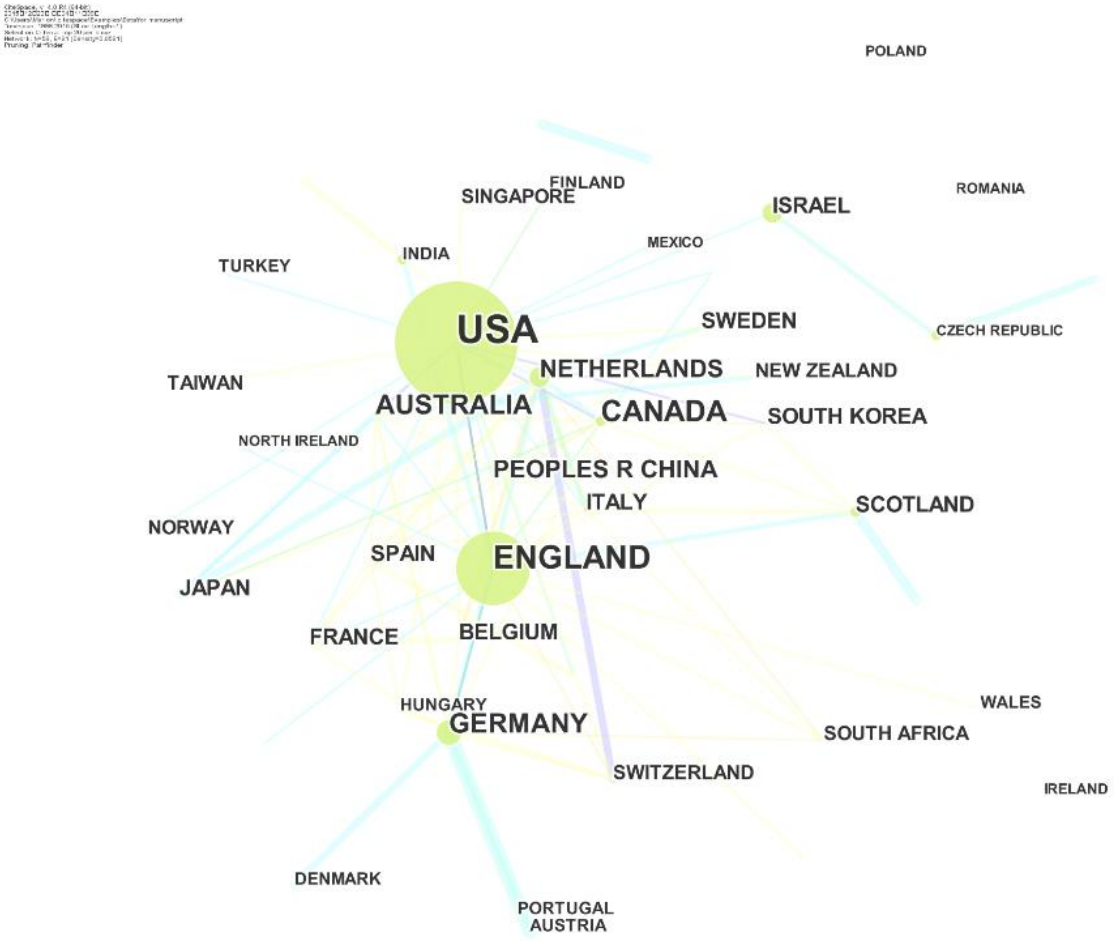
Table-3 below presents the top 20 most productive countries generated from author's institution with regards to publication frequency. The result indicates that the USA is a fundamental contributor of VNPS research: almost 50 percent of the publications are from the USA. Moreover, the results reveal that the top productive countries such as England, Canada and Australia are all English speaking countries. However, Canada and Australia's centrality is lower than Germany and Netherlands, which indicates that European research is also essential to this field. On the other end of the scale, the results show that Peoples Republic of China, France, Belgium and Spain rank in the top 10 in terms of publications but have very low centrality (0.01). The low centrality shows that publications from these four counties make a minor contribution to and possess little importance for the collaboration network despite having high numbers of publications.

Table 3. **Top 20 most productive countries**

Country	Publication	Percentage	Centrality
USA	2055	49.47%	0.51
England	481	11.58%	0.3
Canada	257	6.19%	0.04
Australia	222	5.34%	0.03
Germany	181	4.36%	0.11
Netherlands	133	3.20%	0.09
Peoples R China	97	2.34%	0.01
France	77	1.85%	0.01
Belgium	72	1.73%	0.01
Spain	69	1.66%	0.01
Israel	66	1.59%	0.1
Japan	61	1.47%	0
Scotland	58	1.40%	0.05
South Korea	56	1.35%	0.01
Sweden	56	1.35%	0
Italy	55	1.32%	0.02
Switzerland	42	1.01%	0.02
South Africa	40	0.96%	0
Norway	38	0.91%	0
Singapore	38	0.91%	0

Next, we visualize the countries' publication frequency, network centrality and collaboration network (Graph-4). In the international collaboration network, bigger nodes mean higher centrality i.e. these nodes are at the central position of the network. At the same time, larger fonts mean higher frequencies of publication. Considering both centrality and frequencies, we discover that USA, England, Canada, Australia, Germany and the Netherlands are the most influential countries in the network. We also find that USA, Netherland, England and Germany have more inter-country collaboration than others.

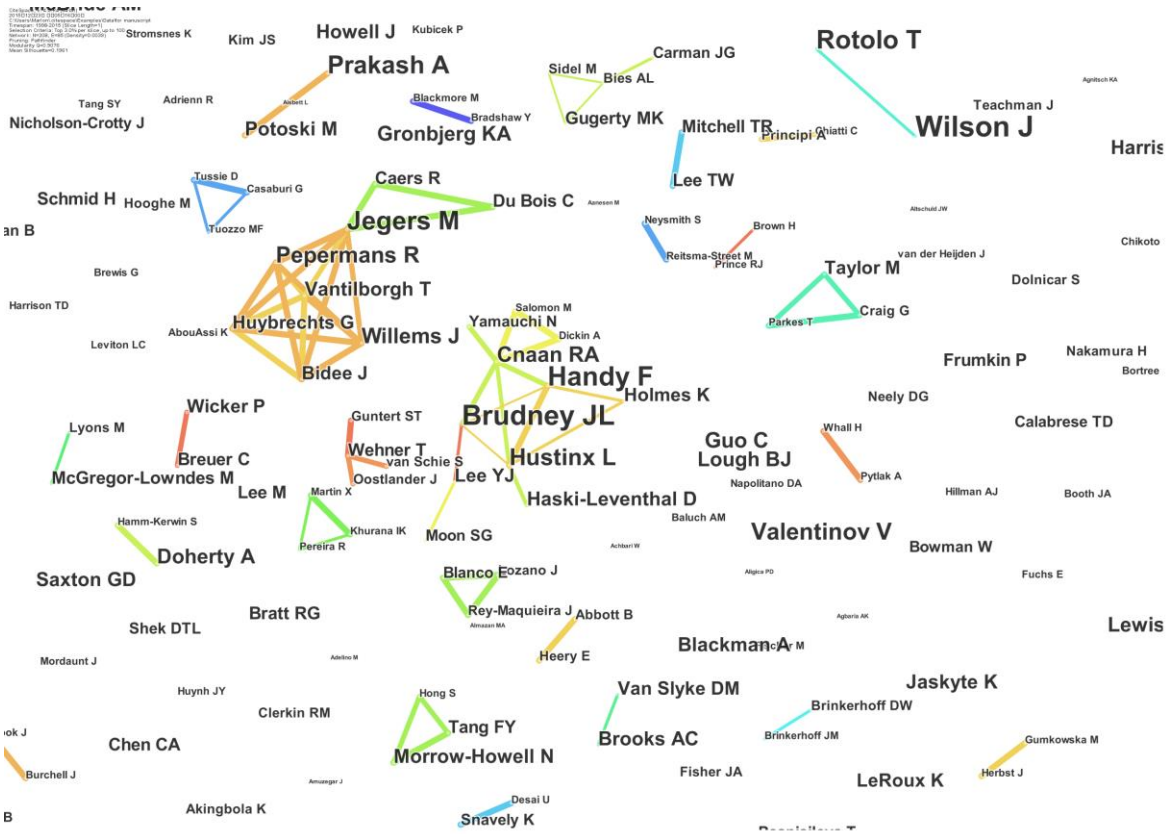
Graph 4. **Visualization of counties' publication frequency, centrality and cooperation network**



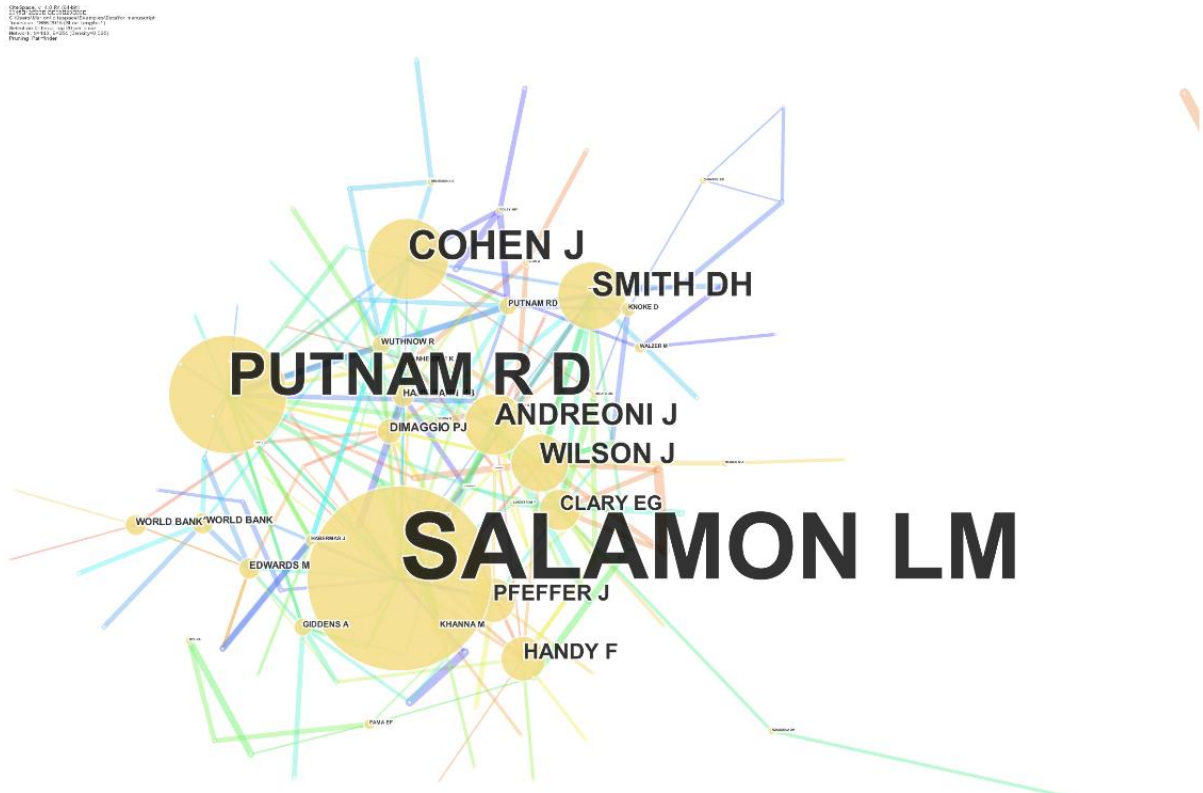
3.2.3 Author Analysis

For this analysis we employ the "Pruning" calculation to select the best Pathfinder and pruning sliced networks to visualize the authoring network. We first visualize a co-author network (Graph-5). Only a few instances of collaboration are present in the network e.g. the green network of Pepermans, Vantiborgh, Huyberchts, Willems and Bidee. However, these collaboration networks are very tight such as Talor, Craig and Parkes. Moreover, some authors act as connectors between actors in the network. For example, Jegers is the key connecting author of two different networks. We then graph author citation frequency, centrality and collaboration network in Graph-6. A highly cited author occupies a critical position in citation networks, while their research received high acclaims from peers. Moreover, the larger a node appears on the network, the greater its influence in the network. Among these authors, Salamon LM, Putnam R D, Cohen J, Smith DH, Wilson J, Andreoni J possess the most influence on VNPS publications.

Graph-5. **Co-author network**



Graph-6. **Cited author network**



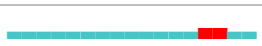
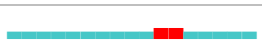
3.3.: The change and continuity of research focus

3.3.1 Keyword

The results from keyword analysis are intriguing. Table-4 lists the top 20 keywords with strongest citation bursts, sorted by strength of the burst. Irrelevant keywords (e.g. time, end, work) are eliminated from the list. Our analysis shows that the strength of the first keyword in the list – civil society – is almost five times of that of the second one – neoliberalism – which manifests the core role of the concept of civil society in the industry. There are other interesting keywords in the list, of which changes in citation bursts are illustrated and visualized, making their temporal trends clearer.

Annual change in keyword citation burst can also indicate trends in the VNPS field with distinctive implications. Take “civil society” as an example. In Table-4 we can see the first five years are marked red, which means that citations of publications with the keyword “civil society” in this period dramatically increased. It suggests that attention to civil society as research topic in this period underwent a sudden increase. Another good example will be “corporate social responsibility” is becoming a heated topic after 2010.

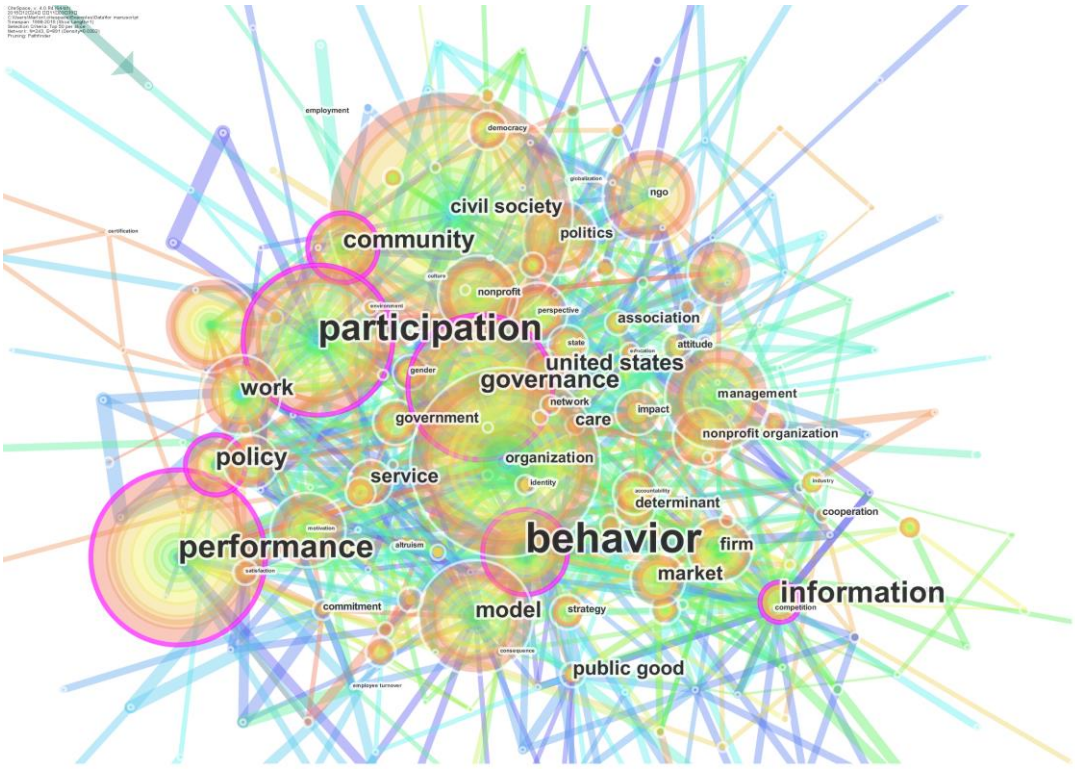
Table-4. **Top 20 keywords with strongest citation bursts**

Keywords	Strength	1998 – 2015 Citation Burst
civil society	23.4182	
neoliberalism	5.5924	
association	4.2115	
law	4.1615	
discretionary disclosure	4.0345	
women	3.8368	
aids	3.8082	
voluntary sector	3.6937	
Africa	3.655	
voluntary association	3.5328	
corporate social responsibility	3.5029	
voluntary turnover	3.4617	

directors	3.3574	
environmental policy	3.3394	
unfolding model	3.28	
welfare reform	3.2553	
incentives	3.2226	
sex	3.0341	
employee turnover	2.9917	
political culture	2.9717	

We then visualize the keywords and their connections to one another. The network displayed in Graph-7 is based on co-citation analysis among the keywords. The connection between each node captures an instance where the same paper cites both of the keywords. Larger circles represent the greater importance of keywords. Deeper shading of the red boundary of circles represents stronger citation bursts between 1998 and 2015.

Graph-7. **Visualization of keyword co-citation network**



3.3.2 Publications with High Centrality

After reviewing the keywords and their co-citation network, we examine the high centrality publications. Both books and journal articles are included here. As previously mentioned, centrality shows how important one paper is in the network. The radius of a node indicates the degree to which a publication has been cited; nodes highlighted in shades of red to purple circles indicate a higher degree of centrality; a larger font also indicates higher centrality.

We list the top 15 high-centrality publications in Table 5 below. In terms of centrality, Skocpol's 2003 book on Diminished democracy shares the highest degree of centrality in the network, which means this book plays a crucial role in linking different academic fields or disciplines. However, Graph-8 shows that Skocpol (2003) does not have as many citations as other notable books (e.g. Putnam, 1995). Also, the outline color of Skocpol (2003)'s circle is purple, indicating that this topic receives a burst of attention during these years. Regarding both citation and centrality, Smith (1994), Putnam (1995), Musick & Wilson (2008), and J. Wilson (2012) also possess high importance in the network. Four of them are all well-known reviewing articles or fundamental research books in VNPS. Moreover, five of these publications are all books such as Howard (2003) and Musick & Wilson (2008). This results clearly shows our research method is more scientific than manual labeling the articles. It reveals the core theories and schools not only focus on VNPS but in all disciplinarians. Due to the limitation of this paper, the discussion of this network will expend in next phase of this research.

Graph-8. **Visualization of core publications' centrality and their network**

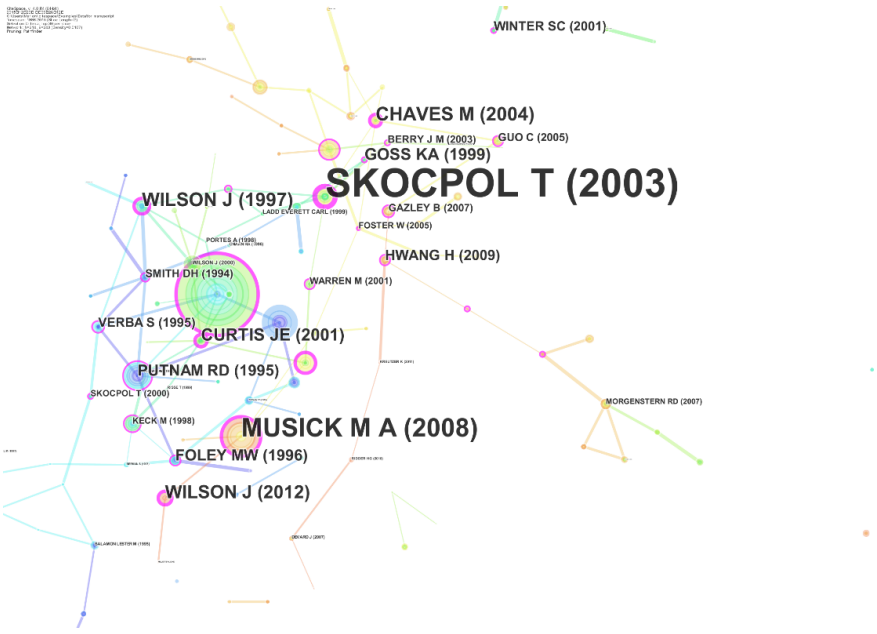


Table-5. **Top 15 High Centrality Publications**

Author	Year	Centrality	Source	Publication Type
Skocpol T	2003	0.46	Diminished democracy: From membership to management in American civic life	Book
Howard M M	2003	0.34	The weakness of civil society in post-communist Europe	Book
Musick M A	2008	0.3	Volunteers: A social profile	Book
Chaves M	2004	0.23	American Sociology Review	Journal Article
Wilson J	2012	0.22	Nonprofit And Voluntary Sector Quarterly	Journal Article
Wilson J	1997	0.22	American Sociology Review	Journal Article
Curtis JE	2001	0.21	American Sociology Review	Journal Article
Putnam R D	2000	0.2	Bowling Alone: The Collapse And Revival of American Community	Book
Goss KA	1999	0.2	Nonprofit And Voluntary Sector Quarterly	Journal Article
Handy F	2000	0.2	Voluntas	Journal Article
Foley MW	1996	0.19	Journal of Democracy	Journal Article
Putnam RD	1995	0.18	Journal Of Democracy	Journal Article
Hwang H	2009	0.18	Administrative Science Quarterly	Journal Article
Long J	1997	0.16	Regression Models for Categorical And Limited Dependent Variables	Book
Eikenberry AM	2004	0.15	Public Administration Review	Journal Article

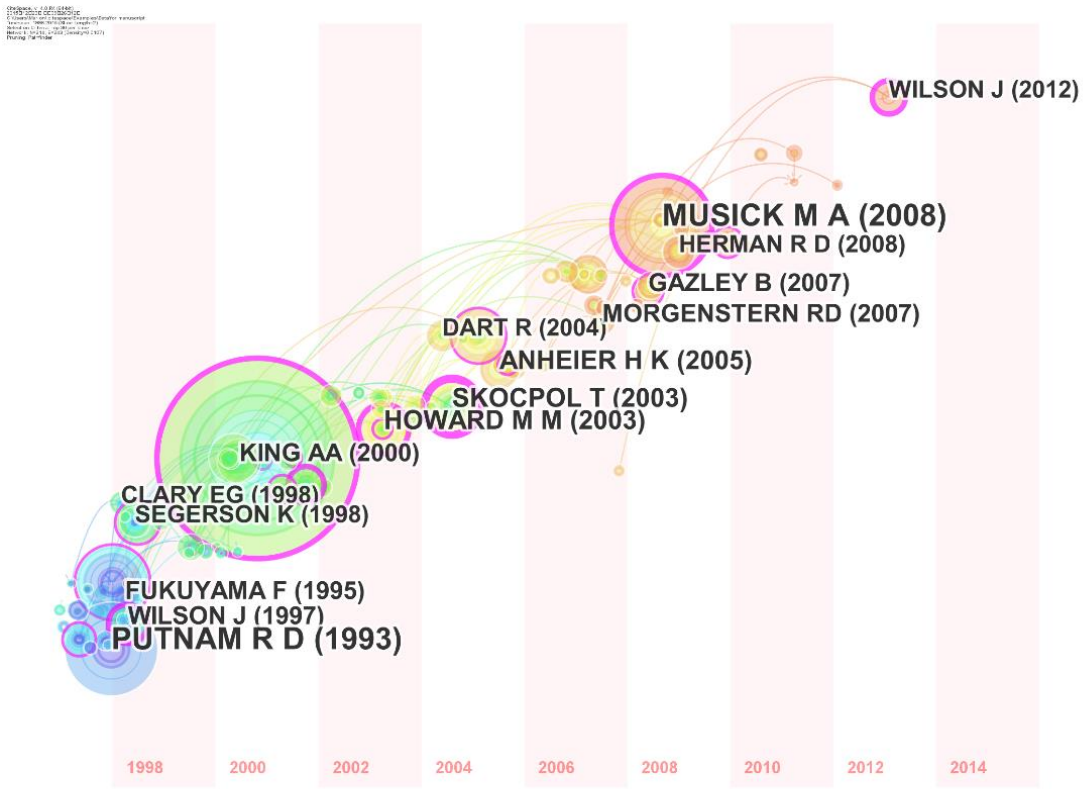
* Table 5 only shows first author's name to simplify the graph and table.

3.3.3 Evolution of highly influential articles between1998-2014

We now summarize the highly-cited publications and visualize emerging changes and continuity in the VNPS field. To show these changes and continuities more clearly, we set the bins at two-year intervals. Graph-9 visualizes the evolution of the types of publications that are highly cited and possess high centrality in the VNPS research network. It is interesting many of the early publications are books not shown in our earlier analyses such as Putnam (1993), Fukuyama (1995) and Wilson and Musick (1997). It shows that the articles before 1998 are mainly focus on these theories.

Besides, King AA（2000）shares the biggest centrality and raised many discussion during 2000 to 2002. It shows this article have the biggest influence among all publication in this period. Also, King AA (2000) are playing a key connecting nodes similar with Skocpol (2003), Dart (2004) and Musick (2008). These are the evidence of the evolution of most heating topics during different periods. Due to the limitation of this paper, the detail will not expand here.

Graph-9. **Evolution of highly influential articles through 1998-2014**



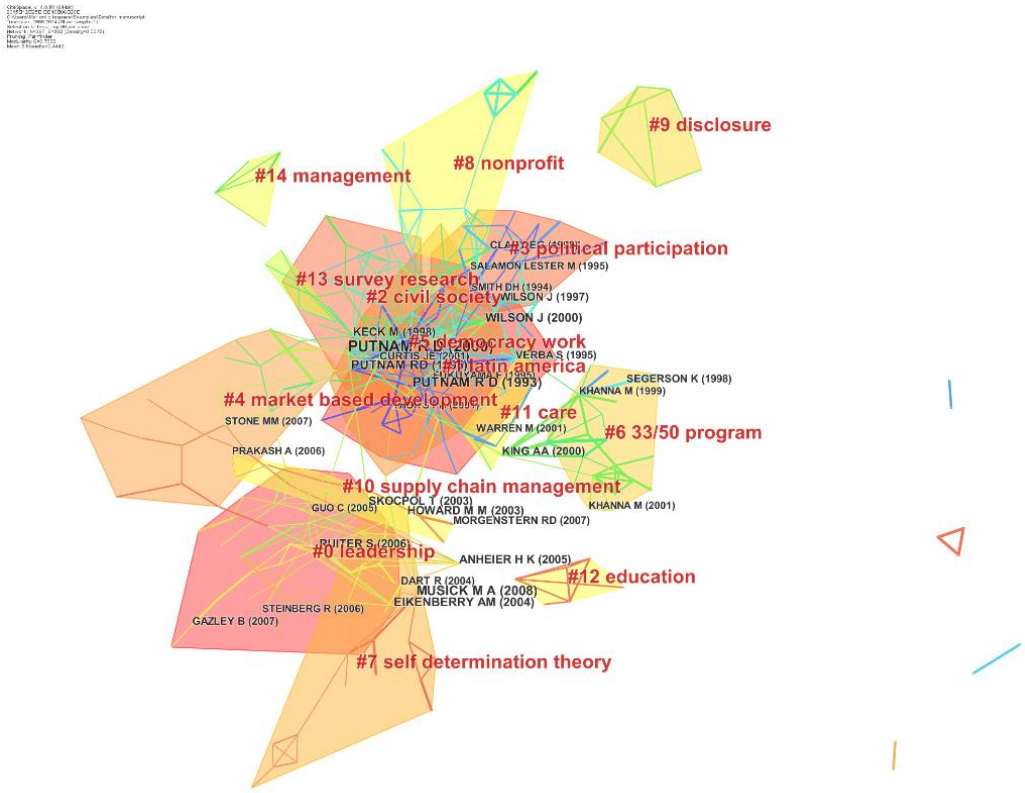
3.4.: Research Theme Network Analysis

After we overview the development trends and analyzed institution, country, author, journal individually, it is interesting to put their network together. We are using Co-citation network, and Institution-Author-Cluster network to visualize the network. Due to the limitation of this research, the details of clusters will not expand and will be discussed thoroughly in next phase of this study.

3.4.1 Cited reference and Keyword network

In co-citation network analysis, we use both “Cited reference” and “Keyword” as node variable and set 30 clusters as selection criteria. The result shows in Graph-10 shows 15 different clusters. In each cluster, we labelled one or two core papers. The clusters are demonstrated by various colors, while the core components are highlighting in red. Due to the limitation of the wording, this research will not review each article in each cluster. The next phase for this analysis will go ahead with co-citation network analysis.

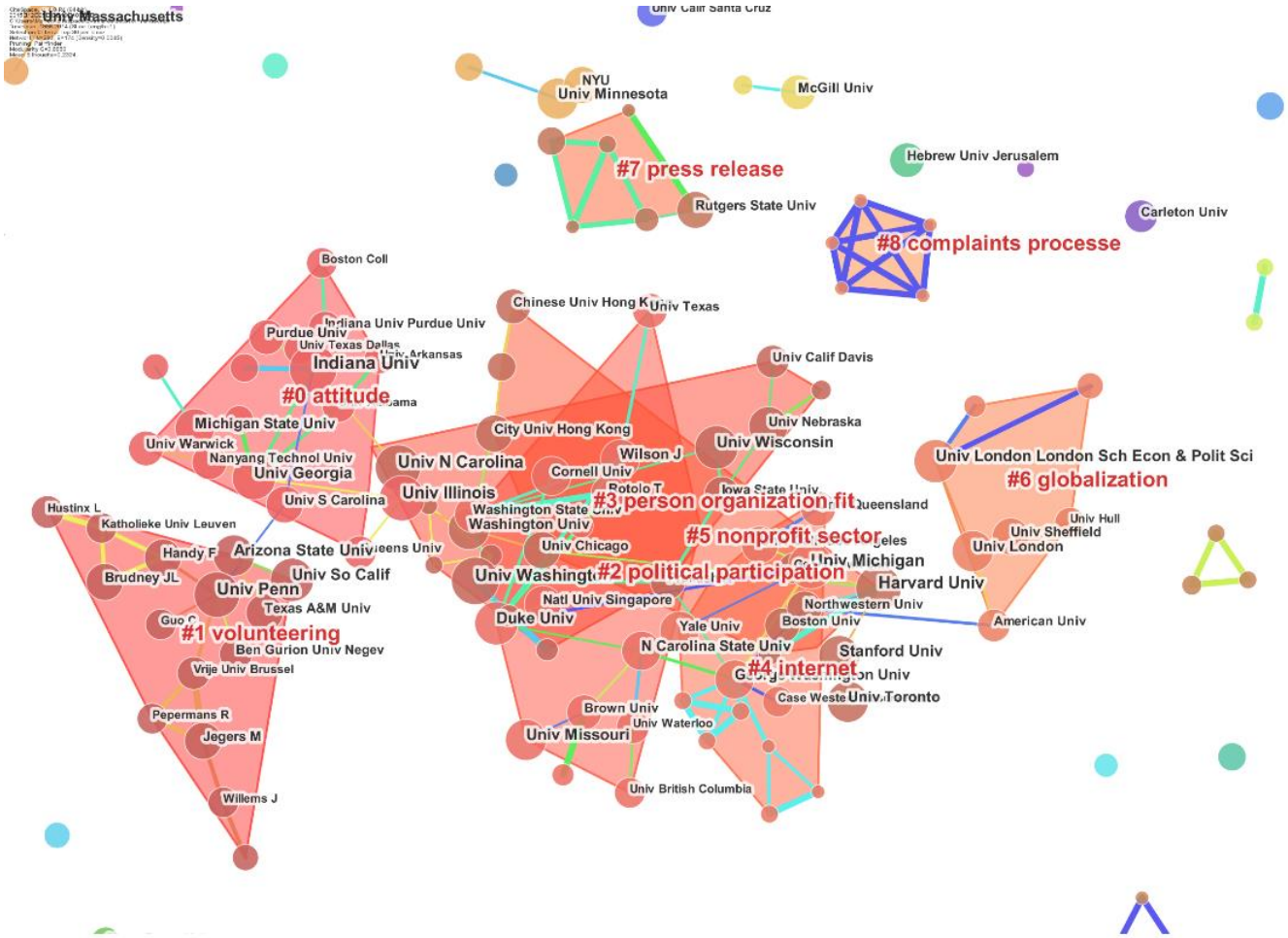
Grarph-10 **Cited reference and Keyword network**



3.4.2. Institution－Author－Cluster network

In this analysis, I put “Author” and “Institution” as the node type, also set 30 clusters as criteria. As we can see in Graph 11, 9 clusters have visualized and labelled. Same as above, the red word designates the keyword of each cluster, and black one indicated the institution. Take No. 6 “Globalization” cluster as an example. American University, LSE, University of Sheffield, University London has created a research network on this issue and have already published few papers together.

Grarph-11 Institution－Author－Cluster Network



As we found two network graph above, there is concrete evidence of an existing global collaboration network, and a flourishing academic community is identified by an analysis of the Institution-Author-Cluster network.

4. Conclusion

This paper attempts to fill the identified gap in the VNPS research literature by applying Scientometrics to visualize the foundation and evolution of this research field. In the past 40 years, some research attempts have been made to review the NGO literature by using traditional article review methods. However, none of them tried to reveal the trends of VNPS research by visualizing the knowledge network in both longitudinal and descriptive manners.

Our paper draws on a broad cross-section sample of 5,170 papers from WoS SSCI database. In total 203,541 references are extracted from these publications and analyzed with a widely-used powerful analytical software. In the finding, a global publication network, keyword trends, citation hotspots, geospatial patterns of the collaboration of NVPS research are first time visualized. And the longtime unidentified nature and development path of the VNPS research will be revealing by computer analysis.

The most significant contribution of this paper is not only to depict interdisciplinary development trends of the VNPS research, but also to decode the context of these changes to provide an overlook of the fundamental knowledge, major institutions, and research focuses on the NGOs research from 1998 to 2015. Our results suggest that VNPS research findings and theories are not influential in more mainstream fields such as political science, economics, sociology, etc. In fact, VNPS is profoundly influenced by these fields. The low centrality of core journals in the citation network further suggests that researchers in this industry must pay more attention to theory building.

Besides, there is substantial evidence of a global collaboration network existing, and Institution-Author-Cluster network identified a flourishing academic community. The second part of the findings illustrated institution, country and author analysis in the past 17 years. In each of the analysis, the top influential individual was listed and visualized in the network. The third part of findings illustrated a knowledge map of the change and continuity of research focus in VNPS. The fourth part of finding adding all information into two cluster networks. We can read a knowledge map gradually revealed by these analyses.

In general, therefore, it seems that an implication of networks is the possibility that an international collaboration network is occurred. Then we realized that to understand what a foundation of one research field needs to carefully read all the top ranking publications in each cluster manually. This is the only profound way to recognize what the sector is really talking. The next phase of the research is already in progress that Professor David

H. Smith has already worked on demystifying the co-citation network with us.

In conclusion, VNPS research is relatively less influenced by the social science area of research; therefore, we call for the further theoretical building. From a methodological perspective, Scientometrics can use in many aspects, from the literature review of each theory to location heating topic in the field. Therefore, we recommend few more tools alone with their publications for readers. First of all, science map technologies is also powerful Co-citation analyses concept (Small, 1973). Now researchers can be widely used all kinds of scientific mapping tool to Scientometrics analysis, including HistCite (Garfield, 2004), VOSviewer (van Eck & Waltman, 2009), Network WorkBench (Börner et al., 2010), DIVA (Morris, Yen, Wu, & Asnake, 2003), Loet Leydesdorff's software (Leydesdorff & Schank, 2008) , CitNetExplorer(Leydesdorff & Schank, 2008)and CiteSpace (C. Chen, 2006). Besides our next phase of research, a quantity of directions for future research may be considered. Also, the same method can be applied widely in social science studies in a various way.

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